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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/694,984

10/29/2003

Masanori Terahara

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03/02/2005

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EXAMINER

LEE, HSIEN MING

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 03/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/694,984

Applicant(s)

TERAHARA ET AL.

Examiner

Hsien-ming Lee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. ____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

HSIEN-MING LEE
PRIMARY EXAMINER

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 102903.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1, 3, 5, 7, 9, 11, 13, 15 and 19 are rejected under 35 U.S.C. 102(e) as being anticipated by Kumar et al. (US 6,696,365).

In re claims 1 and 19, Kumar et al teach a method for fabricating a semiconductor device, comprising the steps of :

- forming a first insulation film 12/14/16 over a semiconductor substrate 10 (Fig.1);
- forming a semiconductor film 18 (i.e. polysilicon) over the first insulation film 12/14/16 (Fig.1);
- forming a resist film 22 over the semiconductor film 18 (Fig.1);
- forming openings in the resist film 22 (Fig.1);
- etching the semiconductor film 18 with the resist film 22 as a mask (Fig.2);
- etching the first insulation film 12/14/16 with the semiconductor layer 18 as a mask (Fig.4); and
- etching the semiconductor substrate 10 with first insulation film 12/14/16 as a mask to form trenches in the semiconductor substrate 10 (Fig.6).

In re claim 3, Kumar et al teach forming trenches in the semiconductor substrate and etching the semiconductor film 18 over the first insulation film 12/14/16 (Fig.6).

In re claims 5 and 7, Kumar et al teach that the step of etching the semiconductor film 18 and the step of etching the first insulation film 12/14/16 are performed in one and the same chamber without the exposure to the atmosphere (col. 4, lines 14-15).

In re claims 9 and 11, Kumar et al teach forming an anti-reflection film 20 after forming the semiconductor film 18 and before forming a resist film 22, in which the step of etching the anti-reflection film 20 to the step of etching the first insulation film 12/14/16 including the first insulation film etching step are performed in one and same chamber without exposure to the atmosphere (col. 4, lines 14-15).

In re claim 13, Kumar et al teach removing the resist film 22 after etching the first insulation film 12/14/16 and before forming the trenches in the semiconductor substrate 10 (Figs. 2, 4 and 6).

In re claim 15, Kumar et al teach removing the resist film 22 after etching the semiconductor film 18 and before etching the first insulation film 12/14/16 (Figs. 2 and 4).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 2, 4, 6, 8, 10, 12, 14, 16 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumar et al. (US '365) in view of Shin (US 2002/0024111).

In re claim 2, Kumar et al. do not teach burying a second insulation film in the trenches.

Shin, in an analogous art, teaches forming a first insulation film 13 over a semiconductor substrate 10 (Fig.1); forming a semiconductor film 15 (i.e. polysilicon) over the first insulation film 13 (Fig.1); etching the semiconductor film 15; etching the first insulation film 13 with the semiconductor layer 15 as a mask (Fig.1); etching the semiconductor substrate 10; and burying a second insulation film 17 in the trenches.

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time of the invention was made, to apply the teaching of Kumar et al. in forming trench isolation structure, as taught by Shin, so that the trenches of Kumar et al. is filled with the second insulation layer, since the trenches of Kumar is basis for the application for the isolation trench structure.

In re claim 4, Kumar et al. in view of Shin teach the claimed limitation, as stated in the rejection against claim 3, since claim 4 recites the same subject matter as of claim 3.

In re claim 6, Kumar et al. in view of Shin teach the claimed limitation, as stated in the rejection against claim 5, since claim 6 recites the same subject matter as of claim 5.

In re claim 8, Kumar et al. in view of Shin teach the claimed limitation, as stated in the rejection against claim 7, since claim 8 recites the same subject matter as of claim 7.

In re claim 10, Kumar et al. in view of Shin teach the claimed limitation, as stated in the rejection against claim 9, since claim 10 recites the same subject matter as of claim 9.

In re claim 12, Kumar et al. in view of Shin teach the claimed limitation, as stated in the rejection against claim 11, since claim 12 recites the same subject matter as of claim 11.

In re claim 14, Kumar et al. in view of Shin teach the claimed limitation, as stated in the rejection against claim 13, since claim 14 recites the same subject matter as of claim 13.

In re claim 16, Kumar et al. in view of Shin teach the claimed limitation, as stated in the rejection against claim 15, since claim 16 recites the same subject matter as of claim 15.

In re claim 20, Kumar et al. teach that the first insulation 12/14/16 comprises silicon nitride 14 and Shin teaches filling the trenches with oxide 17. Therefore, one of the ordinary skill in the art would have been motivated to optimize the materials for the first and second insulation layers such that the first insulation layer is silicon nitride and the second insulation layer is silicon oxide, since by this manner it would be beneficial for selectively removing the second insulation layer from the surface of the substrate to expose the underlying first insulation layer due to the etching selectivity differences between oxide and nitride.

5. Claims 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumar et al. (US '365) in view of Shin (US '111) and further in view of Trivedi (US 2002/0019114).

In re claim 18, Kumar et al. in view of Shin do not teach etching off the first insulation film; and forming a gate insulation film over the semiconductor substrate.

Trivedi, in an analogous art, teaches etching off the first insulation film 29 (Figs. 8-9); and forming a gate insulation film over the semiconductor substrate 27 (Fig. 10).

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time of the invention was made, to etch-off the first insulation film and form a gate insulation film over the semiconductor substrate, as taught by Trivedi, after filling the second insulation in the trench of Kumar et al. in view of Shin, since by doing so it would be able to provide a basis for further forming a gate stack 52, as illustrated in Fig. 10 of Trivedi.

In re claim 17, Trivedi also remedies the deficiency in Kumar et al. in view of Shin because Trivedi teaches forming the second insulation film 48 in the trenches 31 and on the first

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insulation film 29 and chemical-mechanical-polishing (paragraph [0037]) the second insulation film 48 until the first insulation film 29 is exposed.

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time of the invention was made, to combine the teachings of Trivedi with the teachings of Kumar et al. in view of Shin, since by this manner it would provide a flat surface for the subsequent processing steps, i.e. forming the gate stack 52 thereon.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-ming Lee whose telephone number is 571-272-1863. The examiner can normally be reached on Tuesday-Thursday (8:00 ~ 6:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Feb. 24, 2005

Hsien-ming Lee
Primary Examiner
Art Unit 2823
HSIEN-MING LEE
PRIMARY EXAMINER

